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REMARKS

Applicant's invention relates to surface-modified manganese sulfide sinter additives and methods for producing the sinter additives. Coating the surface of the manganese sulfide with between 0.01 and 10 wt.% (relative to the weight of the manganese sulfide) of a wax, organic or inorganic acid ester, oil or low melting point polymer prevents reaction of the particles with moist air, thereby preventing oxidation of the particles. These coatings can be easily removed from during the molding process. Applicant's invention also relates to methods for preparing molded articles from a sinter powder which includes the surface modified manganese sulfide sinter additive.

Claims 17-51 and 53-54 are pending in the application. Claims 52 and 55 have been cancelled and claims 17-32, 41-51 and 53-54 have been amended to define Applicant's invention with greater specificity. Claims 17-32 have been amended to specify that the invention is a sinter additive. Claims 20-25, 29-31 and 41-49 have been amended to define a specific coating agent for each dependent claim. Claim 54 has been amended to more clearly define methods of producing molded articles employing the sinter additive. No new matter is added by these amendments.

Applicant respectfully requests reconsideration of the claimed invention in view of the foregoing amendments and the following remarks.

Rejection Under 35 U.S.C. 112, First Paragraph

The rejection of Claims 51-52 under 35 U.S.C. 112, first paragraph, as not providing enablement for the single means-type claim is respectfully traversed. The Office Action states that the specification does not reasonably provide enablement for the single means-type claim, and that the specification does not enable a person skilled in the art to make and use the invention commensurate in scope with these claims. However, the Office Action fails to specifically point out what aspect of the claims is not properly enabled by the specification.

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Applicant notes that claim 51, as amended, is no longer a means-type claim. Furthermore, Applicant respectfully submits that claim 51 is fully enabled by the specification. See, for example, p. 6, line 37 to p. 7, line 33 (specifically p. 7, lines 19-33), wherein inventive sinter powders (i.e., a sinter powder which includes between 0.1 to 1.0 wt.% of the surface modified manganese sulfide) are employed to produce molded articles.

In view of the above, reconsideration and withdrawal of the rejection is respectfully requested.

Claim 52 has been cancelled, rendering the rejection moot.

Rejection Under 35 U.S.C. 112, Second Paragraph

The rejection of Claim 51 under 35 U.S.C. 112, second paragraph, as being indefinite is respectfully traversed. The Office Action states that it is unclear what is meant by "a... characteristics." Although Applicant respectfully disagrees with the rejection, the claim has been amended to further prosecution. Reconsideration and withdrawal of the rejection is respectfully requested.

Rejection Under 35 U.S.C. 103(a)

a) Relevant Law

To establish a *prima facie* case of obviousness, three criteria must be met; there must be some motivation or suggestion, either in the cited publications or in knowledge available to one skilled in the art, to modify or combine the cited publications; there must be a reasonable expectation of success in combining the publications to achieve the claimed invention; and the publications must teach or suggest all of the claim limitations. *In re Vaeck*, 20 USPQ2d 1438 (Fed. Cir. 1991); MPEP § 2142. In analyzing obviousness, the Court of Appeals for the Federal Circuit has repeatedly cautioned that:

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[t]he factual inquiry... must be based upon objective evidence of record.... [T]he best defense against the subtle but powerful attraction of a hindsight-based obviousness analysis is rigorous application of the requirement for a showing of the teaching or motivation to combine prior art references.... [P]articular findings must be made as to the reason the skilled artisan, with no knowledge of the claimed invention, would have selected these components for combination in the manner claimed.

In re Sang-Su Lee, 277 F.3d 1338, 1343 (Fed. Cir. 2002) (internal citations omitted).

b) Rejection of Claims 17-55 over Chopra in view of other art

The rejection of Claims 17-55 under 35 U.S.C. 103(a) as allegedly being unpatentable over Chopra (U.S. Patent No. 5,768,678), in view of any of Ezis (U.S. Patent No. 5,358,685), Hara (U.S. Patent No. 3,690,930), Mueller (U.S. Patent No. 3,690,930), Halberstadt (U.S. Patent No. 2,666,714), Segura (U.S. Patent No. 3,573,959), Bordenca (U.S. Patent No. 3,401,051) and Koester (4,073,977), and further in view of Bradshaw (U.S. Patent No. 3,669,765) and Copelin (U.S. Patent No. 2,789,070) is respectfully traversed.

The rejection alleges that Chopra discloses that manganese sulfide (MnS) is susceptible to damage by oxidation, and that such oxidation affects its use. (Office Action, p. 3). In stating this, the rejection asserts that Applicant's "problem" (i.e., that prevention of oxidation of MnS is desired) was already known. The rejection turns to nine patents (Ezis, Hara, Mueller, Halberstadt, Segura, Bordenca, Koester, Bradshaw and Copelin) to support the assertion that it was well known in the art to coat metal powders to protect them against oxidation, and that it would have been obvious to coat the Chopra MnS sinter additive to prevent/inhibit its oxidation. (Office Action, page 3-4).

Although Applicant does not dispute that the prior art appreciated the problem of oxidation of an MnS sinter additive, it is respectfully submitted that Applicant's solution to the problem is not disclosed or made obvious over the prior art. However, Chopra, which is the primary reference in the rejection, offers a solution to the problem which is entirely different from that claimed by Applicant. Specifically, Chopra embeds iron into the MnS sinter additive

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(see col. 4, lines 28-56), one result being an increased resistance of the additive to oxidation (Chopra, col. 5, lines 7-9 and 20-32; see also Figure 1). Furthermore, Chopra's sinter additive causes iron to be retained in the molded end product.

In contrast, Applicant's solution to the problem is to coat the MnS sinter additive with any of a number of specified coating agents. In contrast to Chopra, Applicant's sinter additive is coated, rather than embedded. Furthermore, all of the claimed coating materials used by Applicant are released from the end product during molding. The present rejection, however, fails to recognize or acknowledge these key differences in the teachings of the primary reference and that of the claimed invention. Chopra offers a solution which has been ignored by the rejection, which is to solve oxidation of MnS by embedding iron which is retained in the end product.

Thus, Chopra fails to teach or suggest to coat any sinter additive let alone to coat MnS with any of an ester of an inorganic or organic acid, an oil, a low melting polymer, or a mono- or multi-functional aliphatic alcohol with 2 to 12 carbon atoms, wherein the coating agent is present in an amount of 0.01 to 10 wt.% relative to the weight of the manganese sulfide.

For clarity, Applicant will address the teachings of the secondary references separately below.

The Ezis Secondary Reference

Ezis describes adding AlN to SiC and to use this combination in the preparation of mirrored surfaces. Ezis describes that AlN acts as a densification aid. The patent discloses that AlN is hygroscopic and should be coated with a protective film for processing in the presence of water or water vapor.

However, Ezis does not disclose the nature of any such protective films. In addition, Ezis does not describe that use of such undefined films acts to protect AlN from oxidation. As such, Ezis fails to cure any of the deficiencies noted above for Chopra, *i.e.*, coating with an ester

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of an inorganic or organic acid, an oil, a low melting polymer, or a mono- or multi-functional aliphatic alcohol with 2 to 12 carbon atoms, wherein the coating agent is present in an amount of 0.01 to 10 wt.% relative to the weight of the manganese sulfide. Furthermore, there is no motivation to combine the unspecified film coating of AlN with that of Chopra which embeds iron into MnS to obtain the claimed sinter additive.

Additional deficiencies in this combination of references are noted for dependent claims below.

Claims 20-31: Neither Ezis nor Chopra disclosures a coating agent for MnS which is a polyester, polyamide, polyaliphatic compounds, phosphoric acid esters, diphenylchrsylphosphate, or paraffinic or silicon oils.

Claims 35-40: Neither Ezis nor Chopra disclose specific amounts of coating agents used in the production of the coated MnS sinter additive.

Claims 41-49: Neither Ezis nor Chopra disclose the use of a phosphoric acid ester as a coating agent.

Claim 50: Neither Ezis nor Chopra disclose the use of a diphenylcresylphosphate coating.

Claim 54: Neither Ezis nor Chopra disclose the heating of the sinter powder to a temperature sufficient to vaporize the MnS coating.

The Hara Secondary Reference

The rejection fails to identify and Applicant has failed to find any sinter additive disclosed in Hara. The references describes to coat the surface of a cemented carbide intermediate (e.g., WC, TiC, TaC, MoC or CrC) with carboxylic acid or anhydrides thereof (via a vapor deposition). Applicant respectfully submits that such intermediates are not being used as additives. As such, Hara cannot cure the deficiencies noted for that of Chopra.

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Additional deficiencies in this combination of references are noted for dependent claims below.

Claims 18-19, 33-34: Neither Hara nor Chopra disclose specific particle sizes.

Claims 20-21: Neither Hara nor Chopra disclose polymer coatings.

Claims 22-25, 41-49: Neither Hara nor Chopra disclose a phosphoric acid ester coating agent.

Claims 26-28, 50: Neither Hara nor Chopra disclose the use of diphenylcresylphosphate as a coating agent.

Claims 29-31: Neither Hara nor Chopra disclose paraffinic or silicon oils as coating agents.

Claim 54: Neither Hara nor Chopra disclose the heating of the sinter powder to a temperature sufficient to vaporize the MnS coating.

The Mueller Secondary Reference

The rejection fails to identify and Applicant has failed to find any sinter additive disclosed in Mueller. The reference describes the coating of a metal (e.g., iron ore) with bituminous materials (e.g., tars and asphaltenes) to protect against oxidation and water absorption. Applicant respectfully submits that such metal is not being used as an additive. As such, Mueller cannot cure the deficiencies noted for that of Chopra.

Mueller also fails to cure any of the other deficiencies noted above for Chopra, *i.e.*, coating with an ester of an inorganic or organic acid, an oil, a low melting polymer, or a mono- or multi-functional aliphatic alcohol with 2 to 12 carbon atoms, wherein the coating agent is present in an amount of 0.01 to 10 wt.% relative to the weight of the manganese sulfide. Furthermore, the claimed sinter additive cannot be obtained from the combination of the coating

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of metals with bituminous materials of Mueller with the teachings of Chopra which embeds iron into MnS. Additional deficiencies in this combination of references are noted for dependent claims below.

Claims 18-19, 33-34: Neither Mueller nor Chopra disclose particles having diameters less than 200 μ m.

Claims 20-21: Neither Mueller nor Chopra disclose polymer coating agents.

Claims 22-25, 41-49: Neither Mueller nor Chopra disclose phosphoric acid ester coating agents.

Claims 26-28, 50: Neither Mueller nor Chopra disclose diphenylcresylphosphate coating agents.

Claims 29-31: Neither Mueller nor Chopra disclose paraffinic or silicon oils as coating agents.

The Halberstadt Secondary Reference

The rejection fails to identify and Applicant has failed to find any sinter additive disclosed in Halberstadt. The reference teaches the coating of copper and copper-zinc bronze powders with organic compounds (e.g., oils, resins, waxes and stearate compounds) which are then "baked" onto the surface at high temperatures to prevent oxidation of the metal surface. Applicant respectfully submits that such metals are not being used as additives. As such, Halberstadt cannot cure the deficiencies noted for that of Chopra.

Additional deficiencies in this combination of references are noted for dependent claims below.

Claims 20-21: Neither Halberstadt nor Chopra disclose the use of low melting polymers as coating agents.

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Claims 22-25, 41-49: Neither Halberstadt nor Chopra disclose the use of phosphoric acid ester coating agents.

Claims 26-28, 50: Neither Halberstadt nor Chopra disclose diphenylcresylphosphate as a coating agent.

Claims 29-31: Neither Halberstadt nor Chopra disclose the use of paraffinic or silicon oil as a coating agent.

Claims 51, 53-54: Neither Halberstadt nor Chopra disclose methods of producing molded articles from said sinter powder.

The Segura Secondary Reference

The rejection fails to identify and Applicant has failed to find any sinter additive disclosed in Segura. The reference teaches the coating of metal surfaces with olefins in an effort to prevent moisture absorption by the metal surface. Applicant respectfully submits that such metals are not being used as additives. As such, Segura cannot cure the deficiencies noted for that of Chopra.

Additional deficiencies in this combination of references are noted for dependent claims below.

Claims 18-19, 33-34: Neither Segura nor Chopra disclose specific particle sizes.

Claims 22-25, 41-49: Neither Segura nor Chopra disclose phosphoric acid ester coating agents.

Claims 26-28, 50: Neither Segura nor Chopra disclose the use of diphenylcresylphosphate as a coating agent.

Claims 51, 53-54: Neither Segura nor Chopra disclose methods of producing molded articles from said sinter powder.

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The Bordenca Secondary Reference

The rejection fails to identify and Applicant has failed to find any sinter additive disclosed in Bordenca. Bordenca discloses the preparation of oxidation resistant surfaces using terpene ethers to coat the metal particles. Applicant respectfully submits that such metal particles are not being used as additives. As such, Bordenca cannot cure the deficiencies noted for that of Chopra.

Additional deficiencies in this combination of references are noted for dependent claims below.

Claims 20-21: Neither Bordenca nor Chopra disclose the use of polymer coating agents.

Claims 22-25, 41-49: Neither Bordenca nor Chopra disclose phosphoric acid ester coating agents.

Claims 22-25, 41-49: Neither Bordenca nor Chopra disclose diphenylcresylphosphate as a coating agent.

Claims 29-30: Neither Bordenca nor Chopra disclose paraffinic or silicon oils as coating agents.

Claims 51, 53-54: Neither Bordenca nor Chopra disclose methods of producing molded articles from said sinter powder.

The Koester Secondary Reference

The rejection fails to identify and Applicant has failed to find any sinter additive disclosed in Koester. Koester discloses the stabilization of pyrophoric metal powders by treating the metal powders with polymer forming compounds (e.g., alkylene oxides) to form a polymer coating. Applicant respectfully submits that such metal powders are not being used as additives. As such, Koester cannot cure the deficiencies noted for that of Chopra.

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Additional deficiencies in this combination of references are noted for dependent claims below.

Claims 22-25, 41-49: Neither Koester nor Chopra disclose phosphoric acid ester coating agents.

Claims 26-28, 50: Neither Koester nor Chopra disclose the use of diphenylcresylphosphate as a coating agent.

Claims 29-31: Neither Koester nor Chopra disclose the use of paraffinic or silicon oils as coating agents.

Claims 51, 53-54: Neither Koester nor Chopra disclose sinter powders or methods of producing molded articles from said sinter powder.

The Bradshaw Secondary Reference

The rejection fails to identify and Applicant has failed to find any sinter additive disclosed in Bradshaw. Bradshaw discloses methods of applying metal acid phosphate coatings to various metal surfaces by applying a polyvalent metal acid phosphate salt (e.g., zinc and/or aluminum acid phosphate) to produce oxidation resistant coatings. Applicant respectfully submits that such metals are not being used as additives. As such Bradshaw cannot cure the deficiencies noted for that of Chopra.

Additional deficiencies in this combination of references is noted for dependent claims below.

Claims 20-21: Neither Bradshaw nor Chopra disclose the use of polymers for coating agents.

Claims 22-25, 41-49: Neither Bradshaw nor Chopra disclose the specific use of phosphoric acid esters as coating agents.

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Claims 26-28, 50: Neither Bradshaw nor Chopra disclose the use of diphenylcresylphosphate as a coating agent.

Claims 29-31: Neither Bradshaw nor Chopra disclose the use of paraffinic or silicon oils as coating agents.

Claims 51, 53-54: Neither Bradshaw nor Chopra disclose sinter powders or methods of producing molded articles from said sinter powder.

The Copelin Secondary Reference

The rejection fails to identify and Applicant has failed to find any sinter additive disclosed in Copelin. Copelin discloses the use of alkyl acid phosphates coatings to protect metals against oxidation and condition the surface to receive paint finishes. Applicant respectfully submits that such metals are not being used as additives. As such Copelin cannot cure the deficiencies noted for that of Chopra.

Additional deficiencies in this combination of references is noted for dependent claims below.

Claims 20-21: Neither Copelin nor Chopra disclose the use of polymers for coating agents.

Claims 26-28, 50: Neither Copelin nor Chopra disclose the use of diphenylcresylphosphate as a coating agent.

Claims 29-31: Neither Copelin nor Chopra disclose the use of paraffinic or silicon oils as coating agents.

Claims 51, 53-54: Neither Copelin nor Chopra disclose sinter powders or methods of producing molded articles from said sinter powder.

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As indicated, above there are numerous deficiencies in the combination of Chopra in view of any of the nine specified references that are apparent for all of the pending claims. Of the nine secondary references, only Ezis describe a sinter additive and in that case, there are still many deficiencies in Chopra that are not cured by Ezis.

Furthermore, it is respectfully submitted that motivation to combine Chopra with that of any of the other nine references is lacking. Chopra, in providing a working solution to oxidation for MnS that utilizes embedding with an agent that is retained by the final product (i.e. iron), is in conflict with other approaches that teach metal coating for various purposes.

In addition, it is respectfully submitted that even if there would be motivation to combine, a reasonable expectation of success would be lacking. This is because there is no teaching that one can substitute the embedded iron in the MnS sinter additive by instead coating the MnS with any of those presently claimed coating agents, i.e., ester of an inorganic or organic acid, an oil, a low melting polymer, and a mono- or multi-functional aliphatic alcohol with 2 to 12 carbon atoms, wherein the coating agent is present in an amount of 0.01 to 10 wt.% relative to the weight of the manganese sulfide. Furthermore, there is no reasonable expectation that one would obtain a useful sinter additive if the coating of the additive was lost from the product during the molding process. As already noted, Chopra teaches the use of iron as an embedded agent which is retained in the final molded product.

In view of all the above, Applicants submit that all of the claims are not obvious over any of the specified art combinations. Accordingly, reconsideration and withdrawal of the rejection is respectfully urged.

c) Rejection of Claims 54-55 over Storstrom or Uenosono

The rejection of Claim 54 and 55 under 35 U.S.C. 103(a) as being unpatentable over Storstrom (U.S. Patent No. 5,480,469) or Uenosono (U.S. Patent No. 5,938,814) is respectfully

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traversed. Claim 55 has been cancelled, rendering the rejection of this claim as moot. Neither Storstrom nor Uenosono teach each of the elements of amended claim 54.

Storstrom discloses metal powder mixtures which include a base metal powder admixed with additives (including MnS), and a binder. The binder is included to bind the particles of the additives to the surface of the base metal particles. Exemplary binders include diamide waxes.

Storstrom does not disclose the use of a coating agent to separately coat the MnS particles. Rather, Storstrom teaches the use of a binder "to bind the additives to the surface of the base metal particles and, consequently, reduce problems of segregation and dusting." (See col. 1, lines 52-56). The binder in Storstrom is not used as a coating for a sinter additive.

The rejection suggests that a powder made according to Storstrom would be substantially indistinguishable from a powder made according to claim 53. (See Office Action, p. 8). This is incorrect. By the very nature of the steps employed by Storstrom, the powder produced will have a single type of particle – i.e., a particle in which the additive is bound to the surface of the base metal with a binder. In contrast, the sinter powder according to claim 54 will have two separate and distinct particles present – (a) a base metal powder and (b) a MnS sinter additive of which the later includes a surface coating. Thus, the two powders are distinct.

Uenosono, also does not teach a MnS sinter additive which includes the claimed surface coating. Uenosono also fails to teach step (c) of claim 54 wherein the compressed sinter powder is heated to a temperature just above the evaporation temperature of the coating agent.

Thus, neither Storstrom nor Uenosono teach each of the elements of claim 54. Accordingly, reconsideration and withdrawal of the rejection of claim 54 is respectfully requested.

In view of the foregoing remarks, Applicant respectfully submits that the pending claims are in condition for allowance. The Examiner is encouraged to contact the undersigned at the

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telephone number listed below so that any unresolved issues may be resolved without the need for additional action and response thereto.

The Commissioner is hereby authorized to charge any additional fees which may be required regarding this application under 37 C.F.R. §§ 1.16-1.17, or credit any overpayment, to Deposit Account No. 50-0872. Should no proper payment be enclosed herewith, as by a check being in the wrong amount, unsigned, post-dated, otherwise improper or informal or even entirely missing, the Commissioner is authorized to charge the unpaid amount to Deposit Account No. 50-0872. If any extensions of time are needed for timely acceptance of papers submitted herewith, Applicant hereby petitions for such extension under 37 C.F.R. §1.136 and authorizes payment of any such extensions fees to Deposit Account No. 50-0872.

Respectfully submitted,

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